CLAIMS

WHAT IS CLAIMED IS:

1. A two-legged walking robot, comprising:

a pair of foot members;

a calf member provided above each of the foot members;

a double-axis ankle joint provided between each of the respective foot member and the calf member to allow the foot member to rotate relative to the calf member in forward and backward directions and in right and left directions;

a pair of first actuators coupled to both of each of the respective foot member and the calf member to rotate the foot member relative to the calf member about the ankle joint in the forward, backward, right, and left directions;

a femoral member provided above each of the calf members;

a single-axis knee joint provided between each of the respective calf member and the femoral member;

a second actuator coupled to both of each of the respective calf member and the femoral member to rotate the calf member relative to the femoral member about the knee joint in forward and backward directions;

a hip member provided above each of the femoral members;

a double-axis hip joint provided between each of the respective femoral member and the hip member to allow the femoral member to rotate relative to the hip member in the forward, backward, right, and left directions; and

a pair of third actuators coupled to both of each of the respective femoral member

and the hip member to rotate the femoral member relative to the hip member about the hip joint in the forward, backward, right, and left directions.

2. The robot according to claim 1, wherein each of the ankle joints comprise:

a first yoke incorporated with an upper part of the foot member; and

a second yoke incorporated with a lower part of the calf member and coupled to the first yoke so as to rotate the foot member relative to the calf member.

3. The robot according to claim 2, wherein:

the first yoke comprises a first bracket incorporated with the upper part of the foot member, a pair of first supporters upwardly extended from front and rear end parts of the first bracket, and a first-axle to pass through the first supporters in the forward and backward directions, and

the second yoke comprises a second bracket incorporated with the lower part of the calf member, a pair of second supporters downwardly extended from left and right end parts of the second bracket, and a second-axle to pass through second supporters in left and right directions and crosswise incorporated with the first-axle.

4. The robot according to claim 3, wherein each of the hip joints comprise:

a third yoke incorporated with an upper part of the femoral member; and

a fourth yoke incorporated with a lower part of the hip member and coupled to the third yoke so as to rotate the femoral member relative to the femoral member.

5. The robot according to claim 4, wherein each of the hip joints are combined to the hip member rotatably about a vertical axis, and the two-legged walking robot further comprises:

a pair of fourth actuators provided in the hip member to rotate each of the respective femoral members relative to the hip member.

6. The robot according to claim 1, further comprising:

a first link provided between a lower part of the respective first actuators and the foot member so as to rotate the first actuators relative to the foot member; and

a second link provided between an upper part of the respective first actuators and the calf member so as to rotate the first actuators relative to the calf member.

7. The robot according to claim 6, further comprising:

a third link provided between a lower part of the respective second actuator and the calf member so as to rotate the second actuator relative to the calf member; and

a fourth link provided between an upper part of the respective second actuator and the femoral member so as to rotate the second actuator relative to the femoral member.

8. The robot according to claim 7, further comprising:

a fifth link provided between a lower part of the respective third actuators and the femoral member so as to rotate the third actuators relative to the femoral member; and

a sixth link provided between an upper part of the respective third actuators and the hip member so as to rotate the third actuators relative to the hip member.

9. The robot according to claim 7, wherein:

the second actuator is provided in front of the calf member,

an upper part of the third link is pivotably coupled to the lower part of the second actuator, and

a hinge part on which the third link and the second actuator are pivoted is positioned above the knee joint, so that the calf member is rotated backward relative to the femoral member beyond a right angle.

10. The robot according to claim 8, wherein:

the pair of third actuators is provided behind the femoral member,

a lower part of the sixth link is rotatably coupled to the upper part of the third actuators, and

a hinge part on which the sixth link and the third actuators are pivoted is positioned below the hip joint, so that the femoral member is rotated forward relative to the hip member beyond a right angle.

11. The robot according to claim 5, further comprising:

a first link provided between a lower part of the respective first actuators and the foot member so as to rotate the first actuators relative to the foot member; and

a second link provided between an upper part of the respective first actuators and the calf member so as to rotate the first actuators relative to the calf member.

12. The robot according to claim 11, further comprising:

a third link provided between a lower part of the respective second actuator and the calf member so as to rotate the second actuator relative to the calf member; and

a fourth link provided between an upper part of the respective second actuator and the femoral member so as to rotate the second actuator relative to the femoral member.

13. The robot according to claim 12, further comprising:

a fifth link provided between a lower part of the respective third actuators and the femoral member so as to rotate the third actuators relative to the femoral member; and

a sixth link provided between an upper part of the respective third actuators and the hip member so as to rotate the third actuators relative to the hip member.

14. The robot according to claim 12, wherein:

the second actuator is provided in front of the calf member,

an upper part of the third link is pivotably coupled to the lower part of the second actuator, and

a hinge part on which the third link and the second actuator are pivoted is positioned above the knee joint, so that the calf member is rotated backward relative to the femoral member beyond a right angle.

15. The robot according to claim 13, wherein:

the pair of third actuators is provided behind the femoral member,

a lower part of the sixth link is rotatably coupled to the upper part of the third

actuators, and

a hinge part on which the sixth link and the third actuators are pivoted is positioned below the hip joint, so that the femoral member is rotated forward relative to the hip member beyond a right angle.

16. The robot according to claim 5, further comprising:

a shaft to protrude upwardly from the fourth yoke of the hip joint,

wherein the shaft passes through the hip member and is rotatably coupled to the hip member, and

the fourth actuators are rotatably coupled to the shaft to rotate the shaft.

17. The robot according to claim 1, wherein the foot members, the calf members, the femoral members and the hip member are made of a rigid material to support a body to be placed on the hip member.

18. The robot according to claim 3, wherein each of the ankle joints further comprise:

a double-axis trunnion to combine the first yoke with the second yoke to allow relative rotation between the first yoke and the second yoke in the forward, backward, right and left directions.

19. The robot according to claim 18, wherein the first supporters are provided with holes to which opposite ends the first axle are rotatably inserted, allowing the first yoke

to be rotated relative to the second yoke in the left and right directions.

20. The robot according to claim 19, wherein the second supporters are provided with holes to which opposite ends of the second axle are rotatably inserted, allowing the first yoke to be pivoted relative to the second yoke in the forward and backward directions.

21. The robot according to claim 1, wherein each of the single-axis knee joints comprise:

a knee hinge part to connect a part of the calf member with a part of the femoral member to pivot the calf member relative to the femoral member; and

a gudgeon pin to insert into the knee hinge part, allowing the calf member to rotate relative to the femoral member about the knee joint in the forward and backward directions.

22. The robot according to claim 21, wherein each of the single-axis knee joints further comprise:

a double-axis trunnion to combine the third yoke with the fourth yoke to allow relative rotation between the third yoke and the fourth yoke in the forward, backward, right and left directions.

23. The robot according to claim 11, wherein a part of the first link is rotatably coupled to the first yoke incorporated with the foot member, and the second link comprises a first part incorporated with the calf member.

24. The robot according to claim 23, further comprising:

a first hinge pin to rotatably combine the first link and a moving block of the first actuators, providing a first hinge part; and

a second hinge pin to rotatably combine a second part of the second link and a part of the first actuators, providing a second hinge part.

25. The robot according to claim 12, wherein a part of the third link is incorporated with the calf member, and the fourth link comprises a first part incorporated with the femoral member.

26. The robot according to claim 25, further comprising:

a third hinge pin to rotatably combine a part of the third link and a moving block of the second actuator, providing a third hinge part; and

a fourth hinge pin to rotatably combine a second part of the fourth link and a part of the second actuator, providing a fourth hinge part.

27. The robot according to claim 13, wherein a first part of the fifth link is incorporated with the femoral member, and a part of the sixth link is incorporated with the fourth yoke incorporated with the hip member.

28. The robot according to claim 27, further comprising:

a fifth hinge pin to rotatably combine a second part of the fifth link and a moving block

of the third actuators, providing a fifth hinge part; and

a sixth hinge pin to rotatably combine a branched part of the sixth link and a part of the third actuators, providing a sixth hinge part.

29. The robot according to claim 16, wherein the fourth actuators comprise a first part to rotatably couple to a projection provided on the hip member, providing a seventh hinge part, and a second part to pivotably couple to the shaft.

30. The robot according to claim 29, further comprising:

a seventh link having a first part incorporated with the shaft, and a second part to rotatably couple to the second part of the fourth actuators, providing an eighth hinge part.

31. The robot according to claim 30, wherein the fourth actuators rotate the seventh link to rotate the shaft incorporated with the seventh link about a vertical axis, rotating the hip joints, the femoral members, the calf members, and the foot members about the vertical axis.

32. A two-legged walking robot, comprising:

a pair of foot members;

a calf member provided above each of the foot members;

a double-axis ankle joint provided between each of the respective foot member and the calf member to allow the foot member to rotate relative to the calf member in forward and backward directions and in right and left directions;

a pair of first actuators coupled to both of each of the respective foot member and the calf member to rotate the foot member relative to the calf member about the ankle joint in the forward, backward, right, and left directions;

a femoral member provided above each of the calf members;

a single-axis knee joint provided between each of the respective calf member and the femoral member;

a second actuator coupled to both of each of the respective calf member and the femoral member to rotate the calf member relative to the femoral member about the knee joint in forward and backward directions;

a hip member provided above each of the femoral members;

a double-axis hip joint provided between each of the respective femoral member and the hip member to allow the femoral member to rotate relative to the hip member in the forward, backward, right, and left directions;

a pair of third actuators coupled to both of each of the respective femoral member and the hip member to rotate the femoral member relative to the hip member about the hip joint in the forward, backward, right, and left directions; and

a pair of fourth actuators provided on the hip member to rotate each of the respective femoral members relative to the hip member.

33. The robot according to claim 32, wherein each of the first, second, third, and fourth actuators comprise:

a motor;

a ball screw to be rotated by the motor;

a guide rod provided in a part of each of the actuators to engage with the ball screw to be linearly guided by a guide member;

a moving block to attach to an end part of the guide rod; and

a position sensor connected to the guide rod to sense a position of the moving block which moves together with the guide rod.

34. The robot according to claim 33, wherein:

when the moving block of the first actuators moves upward, the foot member rotates backward relative to the calf member, and

when the moving block of the first actuators moves downward, the foot member rotates forward relative to the calf member.

35. The robot according to claim 33, wherein:

when the moving block of a left first actuator of the first actuators moves downward and the moving block of a right first actuator of the first actuators moves upward, the foot member rotates rightward relative to the calf member, and

when the moving block of the left first actuator moves upward and the moving black of the right first actuator moves downward, the foot member rotates leftward relative to the calf member.

36. The robot according to claim 33, wherein:

when the moving block of the second actuator moves downward, the calf member rotates backward relative to the femoral member, and

when the moving block of the second actuator moves upward, the calf member rotates forward relative to the femoral member.

37. The robot according to claim 33, wherein:

when the moving block of the third actuators moves downward, the femoral member rotates forward relative to the hip member, and

when the moving block of the third actuators moves upward, the femoral member rotates backward relative to the hip member.

38. The robot according to claim 33, wherein,

when the moving block of a left third actuator of the third actuators moves downward and the moving block of a right third actuator of the third actuators moves upward, the femoral member rotates rightward relative to the hip member.

39. A two-legged walking robot, comprising:

a pair of foot members;

a calf member provided above each of the foot members;

a double-axis ankle joint provided between each of the respective foot member and the calf member to allow the foot member to rotate relative to the calf member in forward and backward directions and in right and left directions;

a femoral member provided above each of the calf members;

a single-axis knee joint provided between each of the respective calf member and the femoral member;

a hip member provided above each of the femoral members; and

a double-axis hip joint provided between each of the respective femoral member and the hip member to allow the femoral member to rotate relative to the hip member in the forward, backward, right, and left directions.